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ABSTRACT

Single word oral reading was systematically examined in a 6-year-old hyperlexic boy with mental retardation, attention deficit disorder, and hyperactivity. Reading performances were compared to those of normally developing readers and to those of patients with adult-onset alexias to test three hypotheses regarding the mechanisms of reading in hyperlexia. Part-of-speech, imageability, visual configuration, or orthographic regularity had no effect on oral reading. Skills for phonological decoding of all types of real words and for pseudowords that match frequent English orthographic patterns were at reading grade level, but reading was poor for pronounceable pseudowords that have no real word analogies in English. Written word comprehension depended completely on the ability to decipher words phonologically. There did not appear to be any independent contribution of semantics to reading, and reading proceeded primarily or exclusively through a direct phonological lexical route. In all respects the reading pattern in this case matches that of adult patients with generalized dementia of the Alzheimer's type who read without meaning. (Author)

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HYPERLEXIA: A CASE OF READING WITHOUT MEANING

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Single word oral reading was systematically examined in a six year old hyperlexic boy with mental retardation, attention deficit disorder and hyperactivity. Reading performances were compared to those of normally developing readers and to those of patients with adult onset alexias to test three hypotheses regarding the mechanisms of reading in hyperlexia. Part-of-speech, imageability, visual configuration or orthographic regularity, had no an effect on oral reading. Skills for phonological decoding of all types of real words and for pseudowords that match frequent English orthographic patterns were at reading grade level, but reading was poor for pronounceable pseudowords that have no real word analogies in English. Written word comprehension depended completely on the ability to decipher words phonologically. There did not appear to be any independent contribution of semantics to reading, and reading proceeded primarily or exclusively through a direct phonological lexical route. In all respects the reading pattern in this case matches that of adult patients with generalized dementia of the Alzheimer's type who read without meaning.

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Hyperlexia refers to the precocious ability for oral reading in certain young children who manifest otherwise significantly delayed language and cognitive development and serious behavioral disorders (Aram and Healy, 1988). Three accounts of the mechanisms of reading in hyperlexia have been proposed: 1) Cobrinik (1982) suggested that hyperlexics' reading depends primarily on visual configurational/logographic representations and completely bypasses the normal phonological and semantic reading routes. If this suggestion were supported, it would provide evidence for a significant contribution to reading by a logographic system such as that described by Frith (1986). 2) Welsh, Pennington and Rogers (1987) concluded that hyperlexic children most closely resemble the pattern of surface alexia seen in brain-damaged adults. Based on these children's impairments in reading words with irregular spelling-sound correspondence and their many apparent phonological regularization errors, it was suggested that hyperlexics read primarily through a nonlexical phonological reading route. Replication of these results would provide evidence for the existence of an independent nonlexical phonological reading route as is postulated in many current models of reading acquisition (Patterson, Marshall and Coltheart, 1985). 3) Other investigators have proposed that hyperlexics read "without meaning" in a manner similar to adult patients with isolation of the speech areas (Denckla, 1979) and patients with Alzheimer's Disease (Siegel, 1984). Reading is said to proceed through intact visual and phonological systems, in the absence of semantic processing.

The three proposed explanations of hyperlexia were evaluated in a systematic cognitive analysis of the reading performances of a hyperlexic child with mental retardation and attention deficit disorder. Comparisons were made to the performances of normally developing readers and to patients with adult onset neurological syndromes. Our analyses indicate a pattern of oral reading without meaning that appears to primarily utilize lexical phonological processes, and in comparison with acquired reading disorders, most closely resembles the pattern observed in adults with generalized dementia of the Alzheimer's type.

Case Report: L.A. is a 6 y.o., right handed male who was born prematurely at 25 weeks. He has been treated for a seizure disorder since age 2. He experiences left focal motor seizures and generalized seizures. The EEG is abnormal with frequent vertex spikes extending to both parietal regions (greater on the right). By history all developmental milestones were delayed. On examination there was a mild spastic diparesis, a severe attention disorder, hyperactivity and mental retardation (WPPSI FSIQ=51).

At age 3 1/2 L.A.'s remarkably well developed oral reading abilities were first noted by his parents, who had never offered any formal reading instruction. It is believed that he learned to read by watching the television show "Jeopardy". At age 6 he was still without any formal schooling, but his single word oral reading performances on standardized tests fell at an early 3rd grade level.

Experimental Analyses of Single Word Oral Reading:

1. Compared to healthy children (n=6) matched for single word oral reading grade level, L.A. demonstrated significant impairments in comprehending single written words, impairments that were comparable to his auditory comprehension deficits (Table 1). Reading comprehension was possible only for words read aloud correctly and for words that he could comprehend auditorily.

2. In single word oral reading tests (Roeltgen, 1989) L.A. showed effects of imageability (concrete versus abstract nouns), part-of-speech (nouns versus functors) and regularity of the spelling-to-sound correspondence that were similar to those seen in healthy reading grade level matched controls (Table 2).

3. Errors in single word oral reading tasks consisted of orthographic/phonological substitutions some of which resulted in the production of real words and some resulted in production of non-English words. Phonologically accurate errors were infrequent.

4. Degrading the visual word form by introducing visual distractions that distorted the configuration of written words and by randomly deleting portions of letters did not significantly disrupt oral reading of single words.

5. On an experimental test (Friedman, et al, 1991) that included pronounceable pseudowords that have English word analogies (e.g. "glown") and pronounceable pseudowords composed of letter combinations that do not appear in English (e.g., "gwuj") L.A. read the former items at levels comparable to reading grade level matched controls, but he had substantially greater difficulties reading the latter items. His pattern of performance matches a similar dissociation observed in patients with the diagnosis of probable Alzheimer's Disease (Table 3).

Conclusions: The hypothesis that hyperlexic reading depends primarily on visual configurational/logographic representations was not supported by the data in this case. Manipulations which altered or degraded the visual configuration of written words had no effect on oral reading. The apparent success in reading pseudowords consisting of totally unfamiliar logographic/ configurational patterns also argues against this explanation.

The absence of a pronounced difference between L.A.'s reading of orthographically regular and irregular words, and the low rate of regularization errors in oral reading are inconsistent with the hypothesis that the reading of all hyperlexics resembles the pattern of surface alexia. The difference between reading of orthographically regular and irregular words shown by L.A is similar to that seen in normally developing third grade readers (Backman, et al, 1984).

Relative to age peers, L.A. read aloud at an advanced level all types of real words and pseudowords that match frequent patterns of English spelling, but his auditory comprehension abilities were significantly delayed, and his reading comprehension skills were comparably poor. A generalized crossmodal impairment in semantic processing was suggested by the findings. Impairment in semantic processing was observed in the context of seemingly complete preservation of nonsemantic phonological processing of written language.

The data suggest that L.A. was relying primarily or exclusively on a direct phonological route for oral reading. His reading was strongly influenced by word frequency and by analogies to common English orthographic patterns. He was not able to read out loud pronounceable pseudowords that have no English word analogies. These findings argue for significant lexical influences on phonological reading. There did not appear to be any independent contribution of semantics to L.A.'s reading. His comprehension of written words depended completely on his ability to decipher the words phonologically. L.A. read "without meaning" in a manner similar to that seen in adults with generalized dementia of the Alzheimer's type.

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Table 1: Oral reading and comprehension on standardized tests

	Healthy Children (range)*	Hyperlexic - L.A.
WRAT-R Oral Reading Standard Score	73.3 - 127.4	135
WRAT-R Oral Reading Raw Score	44.9 - 83.7	59
PPVT-R Auditory Comprehension Raw Score	59.9 - 118.1	31
PPVT-R Reading Comprehension Raw Score	44.4 - 121.2	21

Table 2: Experimental Reading Tests (Percent Correct)

	Healthy Children (range)*	Hyperlexic - L.A.
Concrete Nouns	50 - 100	85
Abstract Nouns	14 - 100	60
Nouns	91 - 100	97
Functors	74 - 100	73
Regular Spelling	59 - 100	85
Irregular Spelling	38 - 100	50

Table 3: Pseudoword Reading (Percent Correct)

	With English Word Analogies	Without English Word Analogies
Healthy Adults	91	77
Alzheimer's Disease	78	48
Healthy Children	67	43
Hyperlexic - L.A.	77	15

* mean $\pm$ 2 S.D.